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# Elastic and Thermal Properties of Vinylon AN and Vinylon C

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absolute temperature) was observed and the activation energy of viscous flow  $E_s$  was calculated. The values of  $E_s$  for TCP, DOP and DBP (dibutyl phthalate) were 7.5, 7.0 and 5.8 Kcal., respectively (weight ratio, resin 100 : plasticizer 100). TCP gave higher values of  $\eta_s$  than DOP at lower temperatures, but at an elevated temperature this order was reversed (Table).

Values of  $\eta_s$  of plasticized polyvinyl chloride at various temperatures (Weight ratio, resin 100 : plasticizer 100). (unit of  $\eta_s$  : poise).

Plasticizer \ Temp. (°C)	16-28	65	100	150
DBP	$1.53 \times 10^{10}$	$4.34 \times 10^9$	$2.08 \times 10^9$	$3.61 \times 10^8$
DOP	$2.28 \times 10^{10}$	$5.28 \times 10^9$	$1.66 \times 10^9$	$6.92 \times 10^8$
TCP	$3.55 \times 10^{10}$	$5.92 \times 10^9$	$1.82 \times 10^9$	$1.00 \times 10^8$

## 24. Elastic and Thermal Properties of Vinylon AN and Vinylon C

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Various mechanical and thermal properties of an ordinary Vinylon, Vinylon C and Vinylon AN, which were synthesized using the same heattreated polyvinyl alcohol fiber as the raw material, were measured.

Vynlon AN and Vinylon C have higher dry and wet tanacity and wet Young's modulus (Table 1).

Table 1. Mechanical properties (room temp., RH 60-70%).

Materials	Denier	Dry			Wet			Wet and Dry Tenacity Ratio (%)
		Tenacity (g)	Elong. (%)	Young's Modulus (Kg/mm <sup>2</sup> )	Tenacity (g)	Elong. (%)	Young's Modulus (Kg/mm <sup>2</sup> )	
Ordinary Vinylon	1.90	6.04	25.7	496	3.89	29.5	94	64.4
Vynlon C	2.24	7.55	38.4	—	5.59	44.0	—	73.9
Vynlon AN	2.26	6.52	31.2	524	5.12	36.9	264	78.5

Vynlon AN showed higher degree of elasticity than ordinary Vinylon, and more excellent properties at the elevated temperature (Table 2).

Table 2. Mechanical properties at the elevated temperature.

Materials	Temp. (°C)	10	50	100	150	200	220	230
Ordinary Vinylon	Tenacity (g)	5.26	5.46	4.63	3.00	1.51	0.82	0.75
	Elong. (%)	20.8	29.1	37.2	39.7	50.9	36.8	33.1
	Young's Modulus (Kg/mm <sup>2</sup> )	496	349	288	91	25	20	20
Vinylon AN	Tenacity	6.09	5.60	5.00	3.35	2.14	1.71	1.71
	Elong.	25.3	28.2	29.3	30.6	26.1	22.3	23.7
	Young's Modulus	524	266	200	42	21	22	20

## 25. Studies on the Catalytic Action of Basic Catalysts : Factors Governing the Aldol Condensation of Crotonaldehyde

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As R. Kuhn (Ber., 68, 98 (1936)) and S. Hunning (Ann. 569, 198 (1950)) have shown, the aldol condensation of crotonaldehyde takes place only in the simultaneous presence of acid and base, especially when organic nitrogen bases such as piperidine are used as basic catalysts. In reference to this conjugative action of the acid and base catalysts, we have investigated the effect of the natures of acids and bases in combination, the mol ratio of acid to base, the amount and concentration of the catalyst, the reaction temperature, and the solvent upon the reaction.

The extent of the condensation was determined by the removal of the unreacted crotonaldehyde by fractional distillation.

The catalytic activity of the acetate of the cyclic secondary amines such as piperidine or pipercoline ( $\alpha$ ) was found to be by far larger than that of the corresponding tertiary amines, pyridine or picoline ( $\alpha$ ), or that of the ordinary alkali hydroxides.

A molecular proportion of the acid and the base, i.e. acetic acid and piperidine, was satisfactory for the condensation, and an excess of the acid or the base around this mol ratio showed but little effect on the extent of the reaction.

As for the natures of the acid used as catalyst in conjunction with piperidine and pyridine as the basic component it was shown that an acid with a pK value of 3 to 5 is preferable as the acid component of the catalyst. Stronger or weaker acids were found to be quite unsatisfactory in this connection.